to the treatise, by Geo. F. Kunz, on "Gems and Precious Stones of North America," for further information. The author maintains that the Nahuatl term "chalchuitl" referred to turquoise and not to jade and emerald, as stated by E. G. Squier. We note that Brinton, in his "Prehistoric Archæology," applies the term "chalchuitl" to jade alone.

In the same journal A. F. Berlin describes a valuable collection of terra-cotta antiquities from the land of the Incas, and incidentally mentions the fact that these rare specimens had been safely transported long distances by the careful and friendly natives, but were broken and otherwise injured by the New York custom inspectors.

The first number of Vol. I of the *Memoirs of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History* is devoted to Hawaiian Feather Work. The director of the museum, W. T. Brigham, refers to the early voyagers who found the art of feather working in a flourishing state in Hawaii during the latter part of the last century; he then describes and furnishes illustrations of the birds from which the feathers are obtained; the helmets, cloaks, and other articles of feathers are described in more or less detail, and lists are given of the specimens now known to exist in the various museums of the world. The monograph is very fully illustrated, two of the plates being in colors.

GENERAL BIOLOGY.

Physics of Cell Life. — Realizing the prematureness of any present attempt at a chemical understanding of cell phenomena, and believing that there is a large field for interpretation upon a purely physical basis, Dr. L. Rhumbler has devoted himself to a most promising line of investigation — the study of the physics of the cell as explanation of its phenomena; an attempt to analyze cell life, as far as may be, into physical components, leaving the ultimate chemical problems for the future. His previous papers deal with the shell-making of the rhizopods and with cell division; the present,[1] with some of the phenomena of distribution of pigment in eggs and early larvæ.

Assuming that protoplasm is a foam, much as claimed by Bütschli, and that the nucleus and the centrosomes at certain times absorb

[1] Physikalische Analyse von Lebenserscheinungen der Zellen II, III, *Archiv f. Entwick. d. Organismen*, Bd. ix, Sept. 5, 1899, pp. 32–100, Pl. IV.

liquids from the foam, he has argued the necessary occurrence of many of the phenomena of cell division. On the same basis he now attempts to account for the distribution of pigment in many cases.

With the aid of pressure experiments upon the yolk of the hen's egg, the use of his system of elastic bands, and of the interesting gelatine models devised by Bütschli, the author endeavors to support an application of his views to the phenomena described by Fischel in 1899. Fischel placed live eggs of echinoderms in very weak solutions of neutral red, and found that minute granules became stained all through the egg. When the egg divided, these granules were concentrated about the nucleus and in the spindle stage formed a dumbbell-shaped mass; later they were again more uniformly distributed. Rhumbler endeavors to show that this apparent motion of the granules was not due to actual migration, and then explains it as a result of the drying effect postulated in his theory. If the nucleus absorbs water from the neighboring foam, the lamellæ of that foam will become denser and the contents of the alveoli smaller, and large bodies, such as yolk spherules, be squeezed away from such a region of increased pressure. Small bodies may, however, remain, provided they have sufficient adhesion to the alveolar lamellæ. This he assumes to be the case with the minute stained granules. In the region about the nucleus, where water is absorbed and from which large granules are forced away, there will be a condensation that must bring the granules nearer together if they stick to the shrinking lamellæ. The crowding of granules about the nucleus is thus due to a diminution in mass of material and not to a migration of granules from afar.

The author next takes up the arrangement of normal pigment in the eggs of Amphibia. The well-known dark streak that marks the path passed over by the sperm moving within the frog's egg is due, he maintains, not to any attraction on the part of the sperm, nor to any manufacture of new pigment, nor to any other chemical process, but simply to the physical stress produced by the passage of a body through a foam. The sperm adheres to the foam framework and tends to pull it along; the resulting tension behind the sperm leads to outflow of the more liquid contents of the alveoli, and a shrinkage of the framework that draws the adherent pigment granules nearer together.

The pigment is thus concentrated behind the sperm much as the colored granules were concentrated about the nucleus in Fischel's experiments. The granules remain in the region of tension and

diminished volume and so are nearer together; they do not travel to such regions.

Though the reader may not be convinced of the necessity of this explanation, it is certainly most interesting to learn that bubbles of air squeezed through mashed egg masses, and even through artificial mixtures of soot and emulsions, do leave pigmented tracks behind, similar to the sperm track. Some physical explanation of the pigmented sperm track seems forced upon us.

The author then takes up the concentration of pigment upon part of the surface of the frog's egg; the aggregation of pigment about the nucleus in cleavage stages of the frog's egg; the remarkable rearrangements of pigment in isolated cells of frog's eggs when "cytotropic" movements bring them together again; the arrangements of pigment in blastulæ of triton after injury by pressure; and the normal arrangement of pigment in certain cells of the triton in the stages of gastrulation and of formation of neural ridges.

In all cases he applies the same formula: pigment collects in areas of increased pressure and of condensation.

When cells are in active chemical interchange there will be greater adhesion of their applied surfaces and less cohesion of the part of each turned towards its neighbor. The parts of the cells most removed from such interchange will be those of relatively high tension, and in these the pigment, if present at all, may be concentrated by adhering to the shrinking lamellæ. Pigment will be on the denser and chemically inactive sides of cells.

In early stages of development pigment does not indicate active chemical changes where it is found, nor is it of any direct use; it remains inert and is concentrated in areas of condensation or may even be expelled from active areas.

Secondarily, natural selection may have emphasized its occurrence in some places where it happened to be of use.

Aside from the main issue, the author's evidence that invagination and evagination are due to actions of individual cells seems specially interesting.

E. A. A.

Biological Lectures. — The substantial character of the work done at the Marine Biological Laboratory at Woods Holl is evinced by the recently published volume of *Biological Lectures* for 1898.[1] The sixteen lectures thus brought together are by well-known authorities, and touch on one side or another almost all the important biological

[1] *Biological Lectures, from the Marine Biological Laboratory, Woods Holl, Mass., 1898.* 343 pp. Ginn & Company, Boston, 1899.